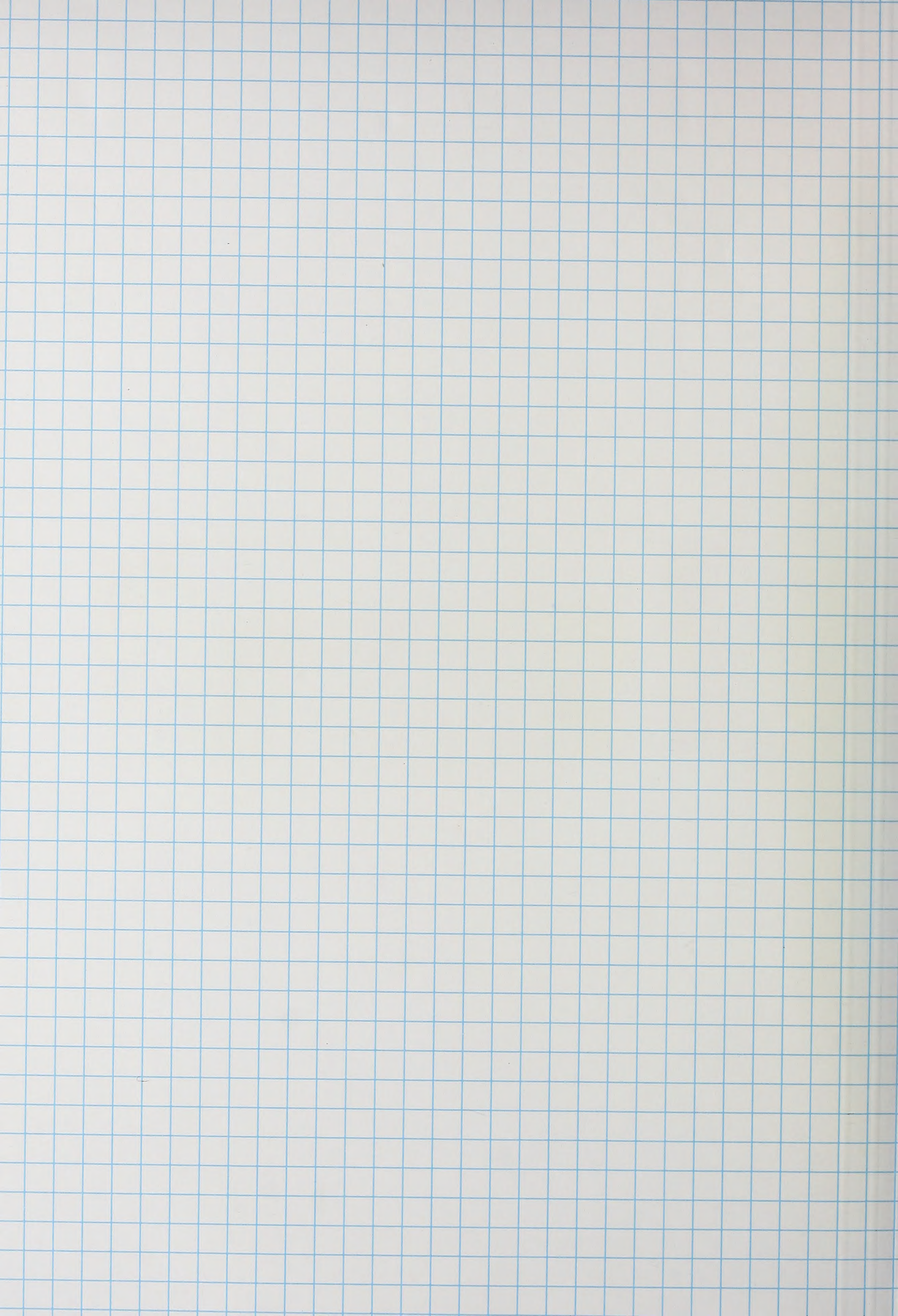


A11106 229018

NIST
PUBLICATIONS

Periodic table Atomic proerties of the
elements

QC
100
.U57
NO.966
2001
C.2



PERIODIC TABLE

Atomic Properties of the Elements

Frequently used fundamental physical constants

For the most accurate values of these and other constants, visit physics.nist.gov/constants

1 second = 9 192 631 770 periods of radiation corresponding to the transition between the two hyperfine levels of the ground state of ¹³³Cs

speed of light in vacuum c 299 792 458 m s⁻¹ (exact) ($h = h/2\pi$)

Planck constant h 6.626 1 × 10⁻³⁴ J s

elementary charge e 1.602 2 × 10⁻¹⁹ C

electron mass m_e 9.109 4 × 10⁻³¹ kg

$m_e c^2$ 0.5110 MeV

proton mass m_p 1.672 6 × 10⁻²⁷ kg

fine-structure constant α 1/137.036

Rydberg constant R_∞ 10 973 732 m⁻¹

$R_\infty c$ 3.289 84 × 10¹⁵ Hz

$R_\infty hc$ 13.605 7 eV

Boltzmann constant k 1.380 7 × 10⁻²³ J K⁻¹

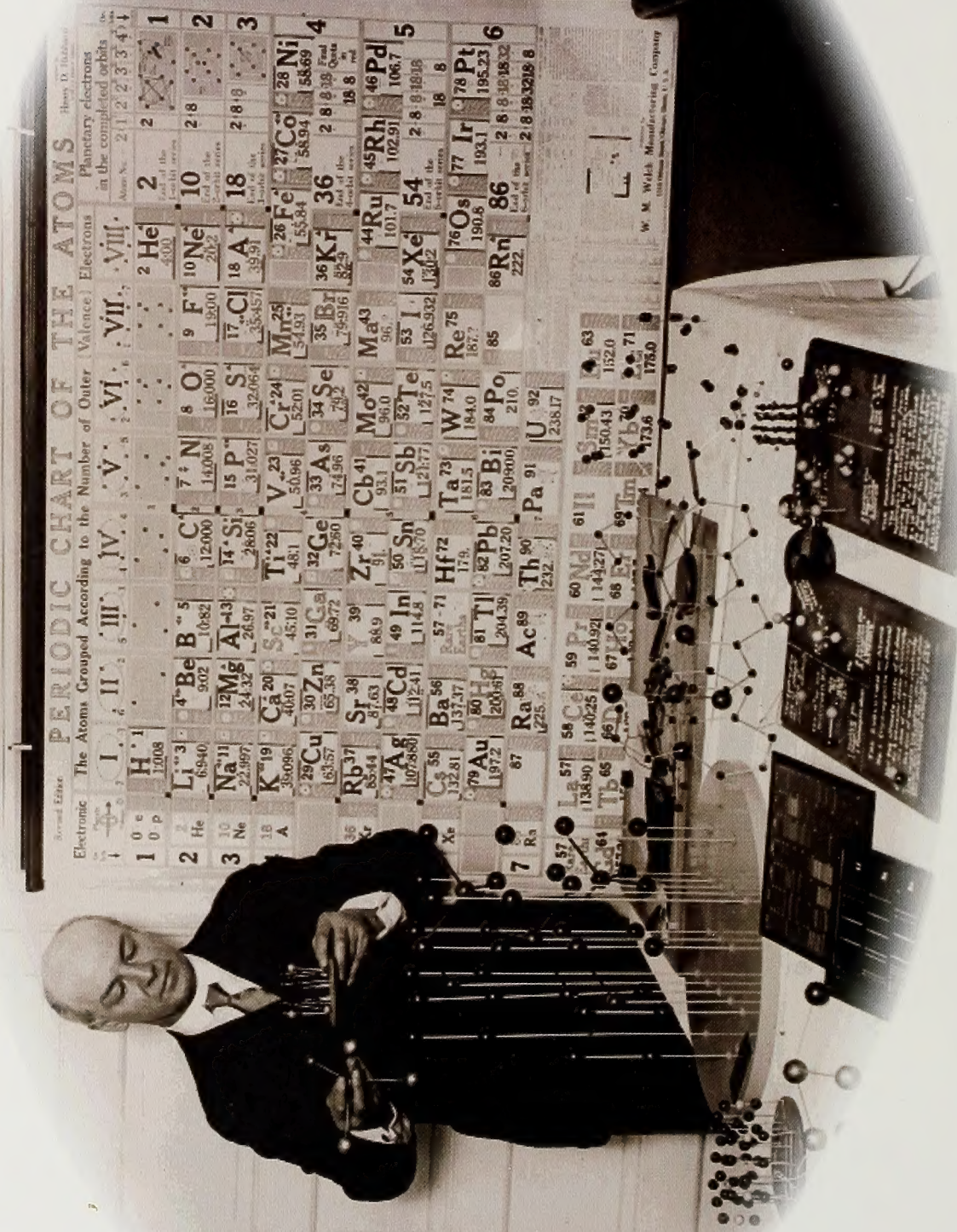
- Solids
- Liquids
- Gases
- Artificially Prepared

Frequently used fundamental physical constants																	
For the most accurate values of these and other constants, visit physics.nist.gov/constants																	
1 second = 9 192 631 770 periods of radiation corresponding to the transition between the two hyperfine levels of the ground state of ¹³³ Cs																	
speed of light in vacuum																	
Planck constant																	
elementary charge																	
electron mass																	
$m_e c^2$																	
proton mass																	
fine-structure constant																	
Rydberg constant																	
R_∞																	
$R_\infty hc$																	
Boltzmann constant																	
k																	

Physics Laboratory physics.nist.gov																		Standard Reference Data Program www.nist.gov/srd																		2																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
IIIB																		IVB																		VB																		VIB																		VIIB																		¹ S ₀																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
5 B Boron 10.811 1s ² 2s ² 2p ¹																		6 C Carbon 12.0107 1s ² 2s ² 2p ²																		7 N Nitrogen 14.00674 1s ² 2s ² 2p ³																		8 O Oxygen 15.9994 1s ² 2s ² 2p ⁴																		9 F Fluorine 18.99840 1s ² 2s ² 2p ⁵																		10 Ne Neon 20.1797 1s ² 2s ² 2p ⁶																		24.5874 1s ²																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
13 Al Aluminum 26.98154 [Ne]3s ² 3p ¹																		14 Si Silicon 28.0855 [Ne]3s ² 3p ²																		15 P Phosphorus 30.97376 [Ne]3s ² 3p ³																		16 S Sulfur 32.066 [Ne]3s ² 3p ⁴																		17 Cl Chlorine 35.4527 [Ne]3s ² 3p ⁵																		18 Ar Argon 39.948 [Ne]3s ² 3p ⁶																		15.7556																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
19 K Potassium 39.0983 [Ar]4s ¹																		20 Ca Calcium 40.078 [Ar]4s ²																		21 Sc Scandium 44.95591 [Ar]3d ¹ 4s ²																		22 Ti Titanium 47.867 [Ar]3d ² 4s ²																		23 V Vanadium 50.9415 [Ar]3d ³ 4s ²																		24 Cr Chromium 51.9961 [Ar]3d ⁵ 4s ¹																		25 Mn Manganese 54.93805 [Ar]3d ⁵ 4s ²																		26 Fe Iron 55.845 [Ar]3d ⁶ 4s ²																		27 Co Cobalt 58.93320 [Ar]3d ⁷ 4s ²																		28 Ni Nickel 58.6934 [Ar]3d ⁸ 4s ²																		29 Cu Copper 63.546 [Ar]3d ¹⁰ 4s ¹																		30 Zn Zinc 65.39 [Ar]3d ¹⁰ 4s ²																		31 Ga Gallium 69.723 [Ar]3d ¹⁰ 4s ² 4p ¹																		32 Ge Germanium 72.61 [Ar]3d ¹⁰ 4s ² 4p ²																		33 As Arsenic 74.92160 [Ar]3d ¹⁰ 4s ² 4p ³																		34 Se Selenium 78.96 [Ar]3d ¹⁰ 4s ² 4p ⁴																		35 Br Bromine 79.904 [Ar]3d ¹⁰ 4s ² 4p ⁵																		36 Kr Krypton 83.80 [Ar]3d ¹⁰ 4s ² 4p ⁶																		13.9996																																																																																																																																																																																																																																																													
37 Rb Rubidium 85.4678 [Kr]5s ¹																		38 Sr Strontium 87.62 [Kr]5s ²																		39 Y Yttrium 88.90585 [Kr]4d ¹ 5s ²																		40 Zr Zirconium 91.224 [Kr]4d ² 5s ²																		41 Nb Niobium 92.90638 [Kr]4d ⁴ 5s ¹																		42 Mo Molybdenum 95.94 [Kr]4d ⁵ 5s ¹																		43 Tc Technetium (98) [Kr]4d ⁵ 5s ²																		44 Ru Ruthenium 101.07 [Kr]4d ⁷ 5s ¹																		45 Rh Rhodium 102.90550 [Kr]4d ⁸ 5s ¹																		46 Pd Palladium 106.42 [Kr]4d ¹⁰																		47 Ag Silver 107.8682 [Kr]4d ¹⁰ 5s ¹																		48 Cd Cadmium 112.411 [Kr]4d ¹⁰ 5s ²																		49 In Indium 114.818 [Kr]4d ¹⁰ 5s ² 5p ¹																		50 Sn Tin 118.710 [Kr]4d ¹⁰ 5s ² 5p ²																		51 Sb Antimony 121.760 [Kr]4d ¹⁰ 5s ² 5p ³																		52 Te Tellurium 127.60 [Kr]4d ¹⁰ 5s ² 5p ⁴																		53 I Iodine 126.90447 [Kr]4d ¹⁰ 5s ² 5p ⁵																		54 Xe Xenon 131.29 [Kr]4d ¹⁰ 5s ² 5p ⁶																		12.1298																																																																																																																																																																																																																																																													
55 Cs Cesium 132.90545 [Xe]6s ¹																		56 Ba Barium 137.327 [Xe]6s ²																		57 La Lanthanum 138.90547 [Xe]5d ¹ 6s ²																		58 Ce Cerium 140.12 [Xe]4f ¹ 5d ¹ 6s ²																		59 Pr Praseodymium 140.90765 [Xe]4f ³ 6s ²																		60 Nd Neodymium 144.24 [Xe]4f ⁴ 6s ²																		61 Pm Promethium (145) [Xe]4f ⁵ 6s ²																		62 Sm Samarium 150.36 [Xe]4f ⁶ 6s ²																		63 Eu Europium 151.964 [Xe]4f ⁷ 6s ²																		64 Gd Gadolinium 157.25 [Xe]4f ⁷ 5d ¹ 6s ²																		65 Tb Terbium 158.925 [Xe]4f ⁹ 6s ²																		66 Dy Dysprosium 162.50 [Xe]4f ¹⁰ 6s ²																		67 Ho Holmium 164.930 [Xe]4f ¹¹ 6s ²																		68 Er Erbium 167.26 [Xe]4f ¹² 6s ²																		69 Tm Thulium 168.934 [Xe]4f ¹³ 6s ²																		70 Yb Ytterbium 173.054 [Xe]4f ¹⁴ 6s ²																		71 Lu Lutetium 174.967 [Xe]4f ¹⁴ 5d ¹ 6s ²																		72 Hf Hafnium 178.49 [Xe]4f ¹⁴ 5d ² 6s ²																		73 Ta Tantalum 180.9479 [Xe]4f ¹⁴ 5d ³ 6s ²																		74 W Tungsten 183.84 [Xe]4f ¹⁴ 5d ⁴ 6s ²																		75 Re Rhenium 186.207 [Xe]4f ¹⁴ 5d ⁵ 6s ²																		76 Os Osmium 190.23 [Xe]4f ¹⁴ 5d ⁶ 6s ²																		77 Ir Iridium 192.227 [Xe]4f ¹⁴ 5d ⁷ 6s ²																		78 Pt Platinum 195.078 [Xe]4f ¹⁴ 5d ⁹ 6s ¹																		79 Au Gold 196.96655 [Xe]4f ¹⁴ 5d ¹⁰ 6s ¹																		80 Hg Mercury 200.59 [Xe]4f ¹⁴ 5d ¹⁰ 6s ²																		81 Tl Thallium 204.3833 [Hg]6p ¹																		82 Pb Lead 207.2 [Hg]6p ²																		83 Bi Bismuth 208.98038 [Hg]6p ³																		84 Po Polonium (209) [Hg]6p ⁴																		85 At Astatine (210) [Hg]6p ⁵																		86 Rn Radon (222) [Hg]6p ⁶																		10.7485	
87 Fr Francium (223) [Rn]7s ¹																		88 Ra Radium (226) [Rn]7s ²																		89 Ac Actinium (227) [Rn]6d ¹ 7s ²																		90 Th Thorium (232) [Rn]6d ² 7s ²																		91 Pa Protactinium (231) [Rn]5f ² 6d ¹ 7s ²																		92 U Uranium (238) [Rn]5f ³ 6d ¹ 7s ²																		93 Np Neptunium (237) [Rn]5f ⁴ 6d ¹ 7s ²																		94 Pu Plutonium (244) [Rn]5f ⁶ 7s ²																		95 Am Americium (243) [Rn]5f ⁷ 7s ²																		96 Cm Curium (247) [Rn]5f ⁸ 7s ²																		97 Bk Berkelium (247) [Rn]5f ⁹ 7s ²																		98 Cf Californium (251) [Rn]5f ¹⁰ 7s ²																		99 Es Einsteinium (252) [Rn]5f ¹¹ 7s ²																		100 Fm Fermium (257) [Rn]5f ¹² 7s ²																		101 Md Mendelevium (258) [Rn]5f ¹³ 7s ²																		102 No Nobelium (259) [Rn]5f ¹⁴ 7s ²																		103 Lr Lawrencium (262) [Rn]5f ¹⁴ 7s ² 7p ²																		104 Rf Rutherfordium (261) [Rn]5f ¹⁴ 6d ² 7s ² 7p ¹																		105 Db Dubnium (262) [Rn]5f ¹⁴ 6d ³ 7s ²																		106 Sg Seaborgium (266) [Rn]5f ¹⁴ 6d ⁴ 7s ²																		107 Bh Bohrium (264) [Rn]5f ¹⁴ 6d ⁵ 7s ²																		108 Hs Hassium (269) [Rn]5f ¹⁴ 6d ⁶ 7s ²																		109 Mt Meitnerium (268) [Rn]5f ¹⁴ 6d ⁷ 7s ²																		110 Un Ununilium (271) [Rn]5f ¹⁴ 6d ⁸ 7s ²																		111 Uu Ununilium (272) [Rn]5f ¹⁴ 6d ⁹ 7s ²																		112 Uub Ununilium (277) [Rn]5f ¹⁴ 6d ¹⁰ 7s ²																		113 Uut Ununilium (289) [Rn]5f ¹⁴ 6d ¹⁰ 7s ² 7p ¹																		114 Uuq Ununilium (289) [Rn]5f ¹⁴ 6d ¹⁰ 7s ² 7p ²																		115 Uuh Ununilium (289) [Rn]5f ¹⁴ 6d ¹⁰ 7s ² 7p ³																		116 Uuh Ununilium (289) [Rn]5f ¹⁴ 6d ¹⁰ 7s ² 7p ⁴																		117 Uhs Ununilium (289) [Rn]5f ¹⁴ 6d ¹⁰ 7s ² 7p ⁵																		118 Uuo Ununilium (293) [Rn]5f ¹⁴ 6d ¹⁰ 7s ² 7p ⁶																		10.7485	

National Bureau of Standards / National Institute of Standards and Technology

First Century of Service to the Nation, 1901 – 2001



The Hubbard Chart of the Atoms, ca. 1924

Henry D. Hubbard, the designer of the "Chart of the Atoms," was the first secretary of the National Bureau of Standards and served continuously in that capacity from 1901 until his retirement in 1938. Secretary Hubbard made a contribution to instruction in physics that is still in use today, his modernization of Mendeleeev's periodic table. First constructed in the 1920's, it has been frequently revised and reprinted.



**Physics
Laboratory**
physics.nist.gov

Oxford.

NO. R152 1/3 BLU

 **ESSELITE**

10%



